AGR/TAC:IAR/88/19 Rev.1

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

THE ROLE OF BIOTECHNOLOGY IN THE CGIAR

TAC SECRETARIAT

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

August 1988

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH

TECHNICAL ADVISORY COMMITTEE

The Chairman

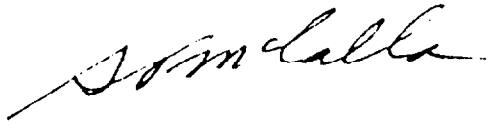
Davis, California
July 29, 1988

Dear Dr. Hopper,

It is with pleasure that I transmit to you, as I agreed at the Group's mid-term meeting in Berlin, the position paper prepared by TAC entitled "The Role of Biotechnology in the CGIAR". This paper is substantially the statement presented by TAC at Berlin and endorsed by the Group. It has however been enlarged somewhat, to cover additional points and concerns raised during the discussion.

It is TAC's considered opinion that this document will serve to guide the Centres in the responsible use of biotechnology. In addition it should encourage an increase in collaborative research between the Centres and specialized academic and private sector institutions. This should be of considerable benefit to agriculture in the developing world.

Sincerely,



Alex F. McCalla
TAC Chairman

Dr. W. David Hopper
Chairman, CGIAR
World Bank
1818 H Street, N.W.
Washington D.C. 20433
USA

THE ROLE OF BIOTECHNOLOGY IN THE CGIAR

TABLE OF CONTENTS

THE ROLE OF BIOTECHNOLOGY IN THE CGIAR

Introduction

The study of practical applications of discoveries in the biological sciences has become widely known as "biotechnology". The term is used in such widely different contexts, however, that it is often misinterpreted. For this reason, TAC has used the term only sparingly in its analyses of research programmes and strategies. Nonetheless TAC has implicitly included advances in biotechnology in more general expressions, such as "strategic research", "upstream research" and "collaborative research with advanced institutions".

The growing interest in biotechnology, however, especially by donors and policy-makers, has made it desirable for TAC to be more explicit. This paper summarizes the opinions already expressed by TAC on issues related to biotechnology, describes further studies in progress and highlights those issues that need to be kept under review.

Maintaining an Awareness of New Opportunities

The rapid rate at which new knowledge is emerging from the biological sciences makes it essential for all concerned, both in the industrialized and the developing countries, to have continuous access to informed opinions on its potential applications. For the future success of agricultural research, it is not just the individual scientists who must keep in touch with new applications, but planners and policy-makers as well. TAC is in a position to make informed judgements on the role of biotechnology in research supported by the CGIAR through the expertise of its individual members, the linkages its members have with advanced institutions throughout the world, and through reports of its review panels and consultants. Its primary responsibility is to recommend strategies to the CGIAR that will optimize returns from investment in research in relation to the Group's accepted goals.

TAC's collective judgement is no substitute, however, for the Centres' own capacity to monitor developments in biotechnology. Only in this way can they identify those innovations most likely to benefit their own research, as well as fulfil their responsibility to help national programmes to maintain an awareness of new possibilities. To meet these needs, TAC has urged Centres to establish linkages with advanced institutions in order to take advantage of advances in biotechnology and has encouraged them to strengthen their expertise in biotechnology through training and recruitment in order that new opportunities should not be missed (1).

The scope of biotechnology is so wide that individual Centres could never be expected to cover more than a tiny fraction of the whole subject. Consequently, basic education in the relevant biological

sciences must clearly remain a responsibility of the universities. The training offered by Centres must continue to be targeted to specific areas related to their mandated activities.

TAC, the CGIAR, the Centres and other international organizations can all contribute to creating a more informed climate of opinion on matters relating to biotechnology. Planners and policy-makers must be alerted both to the realistic opportunities for applying biotechnology to the problems of developing countries as well as to the attendant constraints and costs. Two recent symposia have been helpful in this respect. One, organized by IRRI in October 1986, concentrated on rice. The other, organized by COSTED and CASAFA in December 1987, covered all agricultural applications of biotechnology (2). Both symposia were designed to bring senior administrators and planners in the developing countries into contact with leading research workers involved in the application of new biological techniques to problems in agricultural research. Both stressed the need for training, especially of the older scientists to enable them to interact more effectively with younger scientists trained in the new techniques as part of their university education. They also recognized the need for these younger scientists to widen their perceptions through close interaction with practising plant breeders and animal production specialists.

The transfer of alien genes into plants carries with it the risk of changing the nutritional quality of food derived from them perhaps in ways that might be harmful. Moreover, some genetic transformations might have harmful effects on the environment. For example, the transformation of crop plants to produce toxins to insect pests might disturb the ecological balance of natural insect populations, with adverse effects on the natural enemies of a wider spectrum of crop pests.

TAC and the Centres have an obligation to maintain an awareness of problems of this type and to monitor the development of guidelines and regulations related to them. It is especially important that the Centres should strictly observe accepted codes of practice in all activities related to molecular biology and genetic engineering.

Consideration must also be given to the socio-economic implications for developing countries of changes induced through adoption of the products of biotechnology. It is possible that some innovations might serve to widen the gap between resource-poor farmers and those with access to industrial products as might happen, for example, with the introduction of varieties resistant to specific herbicides.

Equally, other innovations, such as the incorporation of novel forms of virus resistance, might be of greatest benefit to the poorest farmers. Difficult policy choices have to be made, both with respect to the promotion of the products of biotechnology and to the extent of investment in research in any particular aspect. Topics such as these, should progressively be incorporated into socio-economic research in the System.

The System's Capacity for Biotechnological Research

Although all the Centres involved in biological research have invested in the products of biotechnology to a greater or lesser extent, the question is frequently asked whether they are responding rapidly enough to new opportunities. In this connection various suggestions have been made, such as the creation of a special CGIAR fund to support biotechnological research or the funding of a special laboratory for such work within the CGIAR family (3).

TAC's view is that research supported by the CGIAR should continue to be orientated towards the solution of problems, rather than towards the pursuit of new knowledge or the development of new research tools per se. TAC considers that a special CGIAR fund for biotechnology would tend to highlight the techniques rather than the problems. The Committee therefore suggests that biotechnology at the Centres should continue to be funded through the normal processes of priority setting and resource allocation. For similar reasons, TAC considers that investment in a new laboratory staffed by specialists would not represent the most cost-effective use of CGIAR funds (4).

In reaching this conclusion, TAC recognized the opportunities that already exist for the bilateral funding of collaborative programmes between Centres and advanced institutions, such as those discussed at the CGIAR Symposium at Bad Homburg, Fed. Rep. of Germany, 17-22 August 1986 (5). These collaborative arrangements are well suited to meet the main needs of the Centres for strategic research in biotechnology for the foreseeable future.

In general, the modification of technological innovations for application to specific problems is best done collaboratively between the scientists attempting to solve the problems and those involved in the appropriate areas of fundamental or strategic research. It would be prohibitively expensive for the Centres individually, or for the CGIAR to acquire, through a new central laboratory, all the facilities and expertise required to tackle such a diversity of relevant aspects of biotechnology as are likely to arise during the coming decade. TAC therefore considers that it would be a more efficient use of CGIAR resources for the Centres to continue to develop contractual or collaborative arrangements with the institutions best suited to tackle the particular problem.

A good example of the advantages of such arrangements is provided by the recent success of a collaborative programme initiated by IRRI for the modification of techniques of protoplast regeneration for specific application to rice. Indeed, IRRI has extended its collaboration with advanced institutions as part of an informal international network to further the application of molecular genetics and cell biology to rice improvement. Similarly, CIMMYT is participating in a networking approach to the application of recombinant DNA techniques to gene-mapping in maize. All such arrangements have the advantage of enabling the Centres to draw upon the full support of major institutions in ways that it would be extremely costly to duplicate. The CGIAR Secretariat has recently produced a review of these and other aspects of the Centres' work on biotechnology (6).

The role of the Centres should be to evaluate new applications of biological science and assess their potential cost-effectiveness in helping to solve carefully identified problems of high priority. They should continue to develop the facilities required for the routine application of biotechnological innovations, once these become available as a result of their collaborative research. They should also be in a position to assist developing countries, through training, to do likewise. In this way, they will help to bridge the gap between the capabilities of advanced institutions and the needs of programmes of applied agricultural research in the developing countries. No single formula is likely to be appropriate for all Centres for these purposes, however, either with respect to the size of the required facilities or to the composition of staff. The determining factors should relate primarily to the nature of the problems to be solved, but also to considerations such as the opportunities for collaboration.

TAC has consistently supported the Centres in initiatives that conform to these general principles, both in its routine reviews of programmes and budgets, and in its comments on strategic plans. More generally, however, in recognizing concerns that the Centres might lack the capability of exploiting opportunities arising from research in molecular and cell biology, TAC has advocated that the CGIAR should be highly selective in its support for research in these areas. The field is enormous and the System must concentrate its effort on carefully selected problems of high priority if it is to be successful in exploiting those applications most likely to help in the solution of problems related to the productivity of crops and livestock (7).

This principle also applies to the work of ILRAD where TAC has supported investment in biotechnology at a level that is exceptionally high for CGIAR institutions. ILRAD was created to investigate highly specialized problems from the outset and its scientists have been at the forefront of biotechnological research related to two major animal diseases. For example, recombinant DNA techniques are used by ILRAD scientists to synthesize the antigens needed for research on the immune response. Even so, ILRAD recognizes that it cannot cover all relevant aspects of research in the depth required. Accordingly, it also exploits opportunities for collaborative research whenever appropriate.

Relationships with the Private Sector

Commercial investment in biotechnology raises questions about future relationships between the Centres and research institutions in the private sector. In many instances, private sector involvement will be seen as complementary to Centre activities. For example, the private sector is already heavily involved in the development and supply of numerous products resulting from biotechnology, such as the molecular products required in research programmes, improved rhizobial formulations for the inoculation of leguminous crops and pharmaceutical products for animal health.

TAC regards collaboration with the private sector as an important topic which it will keep under review. A TAC sub-committee is currently conducting a study of this subject with a view to analyzing the areas of potential cooperation likely to prove most fruitful for the

Centres. It will also be desirable to identify areas where private sector activities might restrict the freedom of action of the Centres, or restrict the benefits that developing countries might otherwise derive from new opportunities.

In this context, the most commonly expressed concerns relate to the genetic manipulation of plants and possible restrictions on the availability of useful genetic material through the application of patents or other forms of property rights. TAC discussed this topic extensively in 1981 and 1982. The position adopted by the Committee then (8) will shortly be reviewed by the proposed joint TAC/Centre Directors working group on genetic resources (4). If, in the light of recent developments, the statement is no longer considered adequate as a basis for CGIAR policy, then TAC will issue a revised statement.

The Opportunity Cost of Biotechnological Research

Because of the unpredictable outcome of research, investment in any one approach carries with it an opportunity cost represented by the probability of greater success from an alternative approach. In current research on crop improvement, for example, controversy has been created by the difficulties of assessing the relative costs and benefits of radical new approaches to genetic manipulation compared with well established methods. In general, TAC has cautioned against undue involvement by the Centres in high-risk research, especially when there are no indications that the possibilities for further advances along established lines are reaching the point of exhaustion and when the needs for good applied research in the developing countries are still of paramount importance.

There are dangers, however, both that exaggerated claims for the potential impact of biotechnological innovations will give rise to unrealistic expectations and that summary rejection of such claims will result in under-exploitation of real opportunities. TAC and Centre Boards carry major responsibilities in these respects. While TAC has fully recognized the role of biotechnology in agricultural research, it has also kept in mind the nature and magnitude of the problems posed by the challenge to achieve sustainable agricultural production in the developing countries. What, for example, are the prospects of genetically engineering drought resistance in crop plants compared with the prospects of increasing production in drought-prone areas through the more efficient use of rainfall? Striking an appropriate balance between widely different approaches of this type will continue to guide TAC's advice to the Group on the efficient use of the System's resources.

REFERENCES

1. CGIAR Priorities and Future Strategies, Section 4.2.2. (a).

2. Agricultural Applications of Biotechnology. Proceedings of the Nayudamma Memorial Symposium, 15-17 December 1986. Eds. A.N. Rao and H.Y. Mohan Ram, pub. 1987. COSTED: Singapore.

3. Biotechnology: Nature and Scope of Activities at the CGIAR Centres (AGR/TAC:IAR/88/2). Paper presented to the 45th Meeting of TAC, 7-12 March 1988. Rome, Italy.

4. Report of the 45th Meeting of TAC (AGR/TAC:IAR/88/10.1), 7-12 March 1988. Rome, Italy.

5. Scientific Collaboration between European Institutions and International Agricultural Research Centres. - Country and Center Reports (CG/87/08 ii). CGIAR Secretariat, Washington D.C. March 1987.

6. An Overview of Biotechnology Research in the CGIAR. CGIAR Secretariat, Washington D.C. (1988).

7. Elaboration of TAC's Views on Priorities and Strategies (AGR/TAC:IAR/85/18.1). Paper prepared for the CGIAR Meeting in May 1986. Ottawa, Canada.

8. Plant Breeders' Rights. Report of the 27th Meeting of TAC (AGD/TAC:IAR/82/15), 9-17 March 1982. Los Baños, Philippines.